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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/828,437	04/21/2004	Shosuke Endoh	252112US2	5495

22850 7590 05/04/2010
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EXAMINER	
DHINGRA, RAKESH KUMAR	

ART UNIT	PAPER NUMBER
1716	

NOTIFICATION DATE	DELIVERY MODE
05/04/2010	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/828,437	ENDOH ET AL.	
	Examiner	**Art Unit**	
	RAKESH DHINGRA	1716	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _19 April 2010_.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _4-8,11,13-15 and 18-32_ is/are pending in the application.

4a) Of the above claim(s) _4-7,11 and 22-27_ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _8,13-15,18-21 and 28-32_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on _15 November 2006_ is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _02/18/2010_.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

Applicant's argument, see pages 5, 6, filed 4/19/2010, with respect to the rejection(s) of claim 8 under 35 USC 103 (a) that Nishikawa only describes charging the buffer tank (21) with the heat transfer gas at the predetermined pressure during replacement of object W to secure predetermined rear face pressure after exchange of the processed object, and does not teach charging the thin space between the rear surface of object W and the chucking surface of the electrostatic chuck (12) with the heat transfer gas, has been fully considered and is persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Koshimizu et al (US 6,676,804) which when combined with Ogahara and Koshiishi et al reads on claim 8 limitations including a controller configured to set pressure of heat transfer medium to non-zero level during substrate conveyance. Accordingly claims 8, 18-21, 28 and 29 have been rejected under 35 USC 103 (a) as explained below. Balance claims 13-15 and 30-32 have also been rejected under 35 USC 103 (a) as explained below. Applicant's arguments regarding Ogahara not teaching a controller for setting pressure of heat transfer medium are moot in view of new grounds of rejection, since Koshimizu et al teach a controller for setting pressure of heat transfer medium at the contact surface, as explained below.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 8, 18-21, 28 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ogahara (US 5,958,265) in view of Koshiishi et al (US PGPUB No. 2003/0106647) and Koshimizu et al (US 6,676,804).

Regarding Claim 8: Ogahara teaches a plasma apparatus comprising:

a holder main body (susceptor) 1 having an electrostatic chuck 2 on which is mounted an object 10 to be processed that is to be subjected to plasma processing, and a focus ring 9 (characteristic correction ring) having a contact surface disposed in contact with said electrostatic chuck 2 around a periphery of the object to be processed, said focus ring 9 being mounted on

said electrostatic chuck 2 , said electrostatic chuck having a chuck devices 61, 91 to which a chuck voltage is applied (from a DC source 64), and said electrostatic chuck attracting said focus ring by electrostatic attraction generated by the chuck voltage applied to said chuck device;

heat exchange means (a groove on the electrostatic chuck 2) provided at said contact surface, for carrying out heat exchange with said focus ring, said heat exchange means comprising a groove exposed to said contact surface and filled with a heat transfer medium (through a heat transfer gas supply path 71);

a chamber having said susceptor 1 therein, wherein:

said groove is formed in said electrostatic chuck 2;

said heat exchange means further comprises a groove 71 (top point of the supply path) provided at the contact surface between focus ring 9 and the electrostatic chuck 2, for carrying out heat exchange with the focus ring 9 such that the heat transfer medium (helium gas) is filled into the groove 71 and which is covered by the focus ring 9. Ogahara teaches that the cooling means for the focus ring prevent the focus ring from storing up heat from plasma during repetitive wafer processing. Ogahara further teaches that pressure of the heat transfer gas is increased (non-zero pressure) to obtain increased cooling effect by the exchange of heat with the gas, and that there is no observed increase in temperature of focus ring even as time passes due to accumulation of heat during repetitive wafer processing (e.g. Fig. 3 and col. 1, line 30 to col. 3, line 45, col. 6, lines 5-55, and col. 9, line 25 to col. 10, line 25).

Ogahara does not explicitly teach a controller that controls the chuck voltage applied to said chuck device, said controller changing the chuck voltage in accordance with each of multiple sequences of a plasma process; and that said controller sets the chuck voltage applied to

the chuck device high during at least one processing sequence; and further that said controller is configured to control a pressure of the heat transfer medium supplied from said heat exchange means and configured to change the pressure of the heat transfer medium supplied in accordance with each of multiple steps of the plasma process; and still further that the controller is configured to set the pressure of the heat transfer medium 3to a non-zero level during conveying of the object to be processed into and out of said chamber so as to carry out cooling of said focus ring during conveying the object to be processed into and out of said chamber.

Koshiishi et al teach a plasma processing apparatus (Figs. 1, 4) comprising:

A susceptor 11 having an electrostatic chuck (through dielectric films 14a, 14b) on which is mounted a wafer W that is subjected to plasma processing and a focus ring 12 having a contact surface is disposed in contact with said electrostatic chuck around a periphery of wafer W, the focus ring 12 is mounted on the electrostatic chuck having a chucking device 11a, 11b to which a DC voltage 15 is applied and the focus ring is attracted by electrostatic attraction to the electrostatic chuck by the chucking voltage applied to the chucking device 11a, 11b. Koshiishi et al additionally teach a heat exchange means provided at the said contact surface for carrying out heat exchange with the focus ring 12, the heat exchange means comprising an opening (in the dielectric layer 14b for the heat transfer gas coming through passage 17) and filled with heat transfer medium, and further comprising a supply path (connecting portion of supply path 17 to the focus ring 12) that supplies a heat transfer gas to a contact surface between the focus ring 12 and a holder main body portion 11b. Koshiishi et al further teach that for attracting the wafer and the focus ring, different voltages can be applied from power supply 15 through a switch 24 that is controlled by a switch controller 25 (a controller) to control plasma processing as per processing

requirements (that is, a controller that controls supply of voltage to chucking electrode 11a, for chucking the substrate during sequences of plasma processing) [e.g. Figs.1, 4 and para. 0038, 0043, 0055-0059]. It would be obvious to use the controller of Koshiishi et al in the apparatus of Ogahara to control the chuck voltage applied to the electrostatic chuck electrode as per sequence of wafer processing steps. Further, claim limitation "said controller sets the chuck voltage applied to the chuck device high during at least one processing sequence" is a functional limitation, and since the structure of prior art meets the structural limitations of the claim, the same is considered capable of meeting this limitation.

Ogahara in view of Koshiishi et al teach that pressure of the heat transfer gas is increased (i.e. a non-zero pressure) to obtain increased cooling effect by the exchange of heat with the gas (Ogahara – col. 9, line 60 to col. 10, line 2), but do not explicitly teach the controller is configured to control a pressure of the heat transfer medium supplied from said heat exchange means and is configured to change the pressure of the heat transfer medium supplied in accordance with each of multiple steps of the plasma process; and that the controller is configured to set the pressure of the heat transfer medium to a non-zero level during conveying of the object into and out of said chamber so as to carry out cooling of said focus ring during conveying the object to be processed into and out of said chamber.

Koshimizu et al teach a plasma apparatus comprising a processing chamber 102, an electrostatic chuck 108 provided on a lower electrode 106 for supporting a substrate W to be processed. Koshimizu et al further teach a ring assembly 112 comprising inner and outer rings 112a, 112b respectively that encompass the wafer W. Koshimizu et al additionally teach a heat transfer gas (medium) supply pipe 132 that supplies heat transfer gas (helium) between the inner

ring 112a and the lower electrode 106 and a heat transfer gas pressure regulating unit 186 that in turn includes a pressure regulating valve 192. Koshimizu et al also teach a controller 140 that adjusts and controls the pressure regulating unit 186. Koshimizu et al teach that to maintain a uniform temperature of inner ring 112a over repetitive wafer processing, the pressure of helium supplied between the ring 112a and the lower electrode 106 is regulated and the pressure level of helium is maintained at a desired level at all times by the pressure regulating unit 186. Koshimizu et al also teach that due to increase in temperature of wafers due to continuous processing (Fig. 4), helium at a specified pressure (non-zero pressure level) is supplied at the contact surface between the ring 112a and the lower electrode 106, and the pressure level of helium is maintained at all times by the pressure regulating unit 186 (which would include helium supplied at non-zero pressure during the wafer replacement /conveyance period)[e.g. Figs. 1, 2c, 4 and col. 7, line 10 to col. 9, line 3 and col. 9, line 50 to col. 11, line 8]. It would have been obvious to provide a controller that is configured to control pressure of the heat transfer gas (medium) supplied to the contact surface between a focus ring and the electrostatic chuck, on the basis of temperature sensors' input, as taught by Koshimizu et al in the apparatus Ogahara in view of Koshiishi et al to enable control temperatures of the focus ring and obtain uniform radical distribution. Further, it would also be obvious for the controller to set the pressure of the heat transfer medium (gas) at the contact surface to a non-zero level during wafer conveyance, in view of teachings of Ogahara in view of Koshiishi et al and Koshimizu et al to enable control temperature of the focus ring and obtain uniform radical distribution in the process chamber.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to provide a controller that controls pressure of the heat transfer gas and configure the same so as to set the pressure of the heat transfer gas at non-zero level during conveying of the object to be processed from/into the process chamber as taught by Koshimizu et al in the apparatus of in Ogahara in view of Koshiishi et al to maintain uniform temperature of the focus ring and obtain uniform radical distribution in the processing chamber.

Regarding Claim 18: Koshiishi et al teach an electrode 11b built into the chuck device that faces the focus ring 12 (Fig. 4).

Regarding Claims 19, 20: Claim limitations reciting heat exchange means reducing temperature of focus ring to at least 20 degrees C below a temperature of the electrostatic chuck, and to a temperature not more than 0 degrees C are functional limitations, and since the apparatus of prior art meets the structural limitations of the claim, the same is considered capable of meeting the functional limitations.

Regarding Claim 21: Koshimizu et al teach outer ring 112b comprises heating means 148 for heating the outer ring 112b as preheating prior to starting wafer processing so as to stabilize its temperature (col. 11, lines 30-60). Koshimizu et al also teach that heat transfer gas can be supplied between the outer ring 112b and the lower electrode, instead of between the inner ring 112a and the lower electrode (col. 14, lines 42-52). It would be obvious to provide the heater as part of heat exchange means to obtain stabilized temperature of the ring assembly (focus ring) at the start of the wafer processing.

Regarding claim 28: Koshiishi et al teach (para. 0012) the process chamber can be evacuated. Further, claim limitation "the supply path is evacuated when reducing a pressure

inside said chamber" is a functional limitation and since the apparatus of prior art meets the structural limitations of the claim, the same is considered capable of meeting the functional limitation.

Regarding Claim 29: Koshiishi et al teach the apparatus enables includes clamping of focus ring 12 and supply of heat transfer medium to the contact surface between the lower electrode 11and the focus ring 12, through supply path 17 (Fig. 1). Further, claim limitation "wherein the pressure of the heat transfer gas is increased in accordance with incrementing of the chuck voltage during the process sequence" is a functional limitation and since the apparatus of prior art meets the structural limitations of the claim, the same is considered capable of meeting the functional limitation (Relevant case law already cited above under claim 8).

Claims 13, 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ogahara (US 5,958,265) in view of Koshiishi et al (US PGPUB No. 2003/0106647) and Koshimizu et al (US 6,676,804) as applied to claims 8, 18-21, 28 and 29 and further in view of Kanno et al (US 6,373,681).

Regarding Claim 13: Ogahara in view of Koshiishi et al and Koshimizu et al teach all limitations of the claim except the groove has a depth not less than 0.1 mm.

Kanno et al teach a plasma apparatus comprising an electrostatic chuck for supporting a wafer and where the electrostatic chuck has plurality of concentric grooves 46 provided on its top surface, for flowing a heat transfer gas between the wafer and the top surface of the electrostatic chuck. Kanno et al teach the depth of groove is 0.3 mm (meets the claim limitation of not less than 0.1 mm) [e.g. Fig. 14 and col. 17, line 60 to col. 18, line 40].

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide the electrostatic chuck with groove at the contact surface as taught by Kanno et al in the apparatus of Ogahara in view of Koshiishi et al and Koshimizu et al to enable flow heat transfer gas and control temperature of the focus ring and the wafer.

Regarding Claim 14: Kanno et al teach the gas groove is formed in such a shape that a heat transfer gas for promoting cooling of a wafer during processing effectively flows over the entire back surface of the wafer and the groove pattern is capable of giving a desired temperature distribution to the wafer during processing (col. 18, lines 18 -45). It would be obvious to optimize the shape of the groove as per process limitations like to effectively flow the heat transfer gas over the entire back surface of the wafer and giving a desired temperature distribution to the wafer during processing.

Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ogahara (US 5,958,265) in view of Koshiishi et al (US PGPUB No. 2003/0106647) and Koshimizu et al (US 6,676,804) as applied to claims 8, 18-21, 28 and 29 and further in view of Masuda et al (US 2002/0005252).

Regarding Claim 15: Ogahara in view of Koshiishi et al and Koshimizu et al teach all limitations of the claim but do not explicitly teach the groove having an annular shape concentric with the focus ring.

Masuda et al teach a plasma apparatus comprising a processing chamber 100 with an electrostatic chuck 131 for supporting a wafer W and where the electrostatic chuck has plurality of concentric grooves 136, 136B provided on its top surface and where groove 136B is exposed

to the contact surface between the ring 132, 133 and the electrostatic chuck 131, and where the groove 136B is filled with a heat transfer gas. Masuda et al further teach the grooves 136 comprise annular shape concentric with the focus ring 132 (e.g. Fig. 1, 2 and para. 0065-0067).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide the electrostatic chuck with groove of annular shape concentric with the focus ring as taught by Masuda et al in the apparatus of Ogahara in view of Koshiishi et al and Koshimizu to enable provide heat transfer gas uniformly over the rear surface of the substrate.

Claim 30 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ogahara (US 5,958,265) in view of Koshiishi et al (US PGPUB No. 2003/0106647) and Koshimizu et al (US 6,676,804) as applied to claims 8, 18-21, 28, 29 and further in view of Hasegawa et al (US 5,556,500).

Regarding Claim 30: Ogahara in view of Koshiishi et al and Koshimizu et al teach all limitations of the claim except a heating member in contact with said focus ring and covering at least an outer peripheral surface of said focus ring.

Hasegawa et al teach a plasma apparatus with a processing chamber 12 that includes a focus ring 114 and a heating member 116 in contact with outer peripheral surface of the focus ring 114. Hasegawa et al also teach a cylindrical body 124 that surrounds the focus ring 114 and also control the heating of focus ring 114 (e.g. Figs. 6, 7 and col. 9, line 52 to col. 10, line 14). Hasegawa et al does not explicitly teach that heating member 116 covers the outer peripheral surface of focus ring, but teaches that shape of the same is optimized to reduce the deposition of reaction products on the individual parts like focus ring etc.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to provide a heating member in contact with focus ring and whose shape is optimized as taught by Hasegawa et al in the apparatus of Ogara in view of Koshiishi et al and Koshimizu et al to enable control the temperature of the focus ring and minimize the deposition of reaction products on the focus ring.

Claim 31, 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ogahara (US 5,958,265) in view of Koshiishi et al (US PGPUB No. 2003/0106647) and Koshimizu et al (US 6,676,804) as applied to Claims 8, 18-21, 28, 29 and further in view of Birang et al (US 5,491,603).

Regarding Claims 31, 32: Ogahara in view of Koshiishi et al and Koshimizu et al teach all limitations of the claim except the controller is configured to control the chuck voltage to maintain a same polarity during the at least one processing sequence as during conveying the object from the chamber, and the controller is configured to control the chuck voltage to a first non-zero level during processing and configured to control the chuck voltage to a second non-zero level during conveying of the object into and out of said chamber.

Birang et al teach a plasma apparatus comprising a heat exchange gas system for an electrostatic chuck that includes a pressure transducer 240, a flow controller 230 and a controller 250. Birang et al further teach that the controller 250 enables control of chucking/dechucking voltage applied to electrostatic chuck. Birang et al also teach that a positive voltage of 2000V (non-zero voltage) is applied to electrostatic chuck during wafer's conveyance (before the wafer is place on the chuck (that is during conveyance of the wafer) and further during processing also

a positive voltage (non-zero voltage) is applied for chucking (since the wafer bias adds to the chucking voltage) [e.g. Fig. 2 and col. 3, lines 35-65].

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to configure the controller to control the chuck voltage to maintain a same polarity during the at least one processing sequence as during conveying the object from the chamber and apply non-zero voltages during the conveyance of wafer and during wafer processing as taught by Birang et al in the apparatus of Ogahara in view of Koshiishi et al and Koshimizu et al to obtain effective chucking of wafer to the substrate during processing.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to RAKESH DHINGRA whose telephone number is (571)272-5959. The examiner can normally be reached on 8:30 - 5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on 571-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/R. D./
Examiner, Art Unit 1716

/Karla Moore/
Primary Examiner, Art Unit 1716